

**WORK PLAN**

**REC'D**

**MAR 29 1999**

**RCAP**

# **Ground Water Sampling and Analysis Plan**

**Inland Realty Company  
Maryville, Missouri**

**March 1999**





**O'BRIEN & GERE**  
ENGINEERS, INC.

REC'D

MAR 29 1999

RCAP

**Transmittal**

To: Chief, Permits Section  
MDNR Hazardous Waste Program  
1738 East Elm Street (Lower Level)  
PO Box 176  
Jefferson City, MO 65102

Date: March 25, 1999

File: 3050.005

Re: Inland Realty Company  
Maryville, MO

We are sending you:

X herewith    under separate cover:    drawings X descriptive literature    letters

If material received is not as listed, please notify us at once.

Quan.	Identifying Number	Title	Action*
3	3050.005	Ground Water Sampling and Analysis Plan for Inland Realty Company, Maryville, MO	Y

\*Action letter code:

**R**-reviewed  
**S**-resubmit

**N**-reviewed and noted  
**J**-rejected

**I**-for your information  
**Y**-for your approval

**Remarks:**

cc: Millard Cohen - Nixdorff Krein Industries (1 rpt)  
Chief, RCRA Permitting & Compliance  
Branch - USEPA Region VII (2 rpts)

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.

James R. Myers, PE  
Senior Project Engineer

WORK PLAN

# Ground Water Sampling and Analysis Plan

*Inland Realty Company  
Maryville, Missouri*

A handwritten signature in black ink, reading "Dean L. Palmer", is written over a horizontal line.

Dean L. Palmer, PE  
Vice President

March 1999



5000 Cedar Plaza Parkway  
Suite 211  
St. Louis, Missouri 63128

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## 1. Objective

The purpose of this Ground Water Sampling and Analysis Plan (SAP) is to provide information on the procedures and techniques used in conducting ground water sampling, analysis, and monitoring activities at the Inland Realty Company site (Figure 1) in Maryville, Missouri. This SAP has been developed to meet the regulatory requirements contained in 40 CFR, Part 264, Subpart F and conditions described in Missouri Hazardous Waste Management Facility Permit Part I (Permit Number MOD099238784).

The Ground Water Monitoring and Compliance Monitoring Program, as described in Special Permit Condition II, consists of semi-annual ground water sampling and analyses, semi-annual ground water elevation measurements, and comparison of analytical data to permit-established Ground Water Protection Standards (GPS). The first sampling event under this SAP will be the first regularly scheduled sampling event following approval of this draft SAP. This SAP is a revision of the previous SAP dated August 1997.

## **Ground Water Sampling and Analysis Plan**

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## **2. Ground water compliance monitoring plan**

This chapter describes the ground water monitoring program to be implemented at the Inland Realty Company property in Maryville, Missouri (Figure 2). The purpose of this program is continued assessment of the ground water quality at the site during the permit compliance period. If three consecutive years of semi-annual sampling indicates no exceedences of the permit-established GPS, listed in Table I of the Permit, the permittee may request that ground water sampling be discontinued. The current ground water monitoring network has been deemed to be adequate to be used to monitor ground water quality and to be able to detect whether constituents of concern are migrating downgradient of the property.

### **2.1. Monitoring wells**

The Compliance Monitoring Program ground water monitoring well network consists of thirteen ground water monitoring wells as shown on Figure 2. The following monitoring wells have been selected as point of compliance (effectiveness) wells and will be sampled semi-annually: GMW #2S, GMW #2D, GMW #3, GMW #3S, GMW #3D, GMW #4S, GMW #4D, GMW #5S, and GMW #5D. The following wells complete the monitoring well network and will be sampled annually: GMW #6S, GMW #6D, GMW #7, and GMW #9.

Additional effectiveness wells may be installed during the compliance period, if necessary, to meet the requirements of 40 CFR 264 Subpart F. Changes to the list of the effectiveness wells are subject to modification in accordance with 40 CFR 270.42 and are subject to Missouri Department of Natural Resources (MDNR) approval. Within 30 days of written MDNR approval, a revised SAP incorporating the approved changes will be submitted to the MDNR.

Static ground water elevations will be measured on a semi-annual basis for the compliance monitoring well network and the four piezometers.

## **2.2. Monitoring well system inspection**

During each ground water sampling event, a monitoring well system inspection will be performed. The ongoing inspection program will evaluate the general condition of the monitoring well system in order to recommend and implement remedial/rehabilitation measures, if necessary. This information will be included on the Field Sampling Log that includes a monitoring well integrity checklist, a copy of which is included as Appendix A. In addition, the total depth of the monitoring wells will be measured once a year to assess whether siltation is occurring. Wells that exhibit variations in total depth of greater than 5% of total screen length (an indication of sediment accumulation within the wellbore) will be redeveloped. Well redevelopment will be accomplished using bailing or low-yield pumping methods. Successful rehabilitation will be documented by a total well depth measurement that demonstrates minimal well screen occlusion (ideally zero).

Monitoring wells which are assessed to have been damaged or to have damaged surface seals will have repairs undertaken within 7 days and will be restored as follows:

- Surface seals and protective covers will be removed. Precautions will be taken not to disturb the well casing or integrity of the monitoring well.
- A cement/bentonite grout will be used to seal the annulus to just below the frost line. At that point, a continuously poured concrete pad of expansive cement will be emplaced around the well casing. The pad will be a minimum of 4 inches thick and extend outward at least 1.5 ft.
- Upon completion of the well repairs, the top of each casing will be resurveyed to verify that the work efforts have not resulted in the displacement of these casings.
- If it is assessed that the integrity of the monitoring well installation has been compromised and rehabilitation efforts cannot be successfully implemented, a replacement well will be installed and/or the well will be abandoned according to state regulations after concurrence with MDNR.

MDNR will be notified at least five days in advance of construction or modification of the ground water monitoring system, as required by Special

Permit Condition II.D.5. Replacement of an existing well that has been damaged or rendered inoperable without change to location, design, or well depth requires a Class I permit modification.

### **2.3. Ground water monitoring well abandonment/installation**

A damaged monitoring well which cannot be repaired or restored will be replaced with a new monitoring well. The abandoned monitoring well will be sealed in accordance with Missouri regulation 10 CSR 23, Chapter 4. Documentation of the methods pertaining to well plugging and abandonment and well abandonment registration forms will be submitted to the MDNR, Division of Geology and Land Survey (DGLS). A copy of the well registration form and registration acceptance will be included as part of the Annual Ground Water Compliance Monitoring Report (Special Permit Condition II.F). Any change in the number of wells to be monitored requires a Class II Permit Modification, in accordance with 40 CFR 270.42.

Monitoring well replacement installation will be completed using conventional hollow-stem auger drilling methods. New monitoring wells will be installed in accordance with 10 CSR 23, Chapter 4. Split-spoon soil samples will be collected every 2 ft or change in formation, according to ASTM Method D1586.

The monitoring well will be constructed of a 10-ft section of 2-inch inner diameter (ID), manufactured 0.010-inch slotted polyvinyl chloride (PVC) well screen, and appropriate lengths of compatible 2-inch ID, solid, threaded, flush-joint PVC riser pipe. Prior to installation, well materials that have not been pre-cleaned will be steam-cleaned to remove dirt, grease, oil, or other potential contaminants which may have come in contact with the materials during transport.

The 10-ft well screen section will be installed to intersect the defined permeable zone, but not to extend into the overlying silt and clay or the underlying till confining layer. A clean, washed, graded sand pack will be placed around the well screen and extend approximately two feet above the screen top. A minimum of 2 ft of a bentonite seal will then be emplaced above the sand pack and the remaining annular space filled with bentonite/cement grout via a tremie line with horizontal discharge outlets. Sufficient time will be allowed to hydrate the bentonite pellets prior to grouting the well annulus. The minimum recommended time for this to occur is 4 to 6 hr within a

saturated zone. Should the seal be installed in the vadose zone, clean tap water will be added to the wellbore annulus as required to promote bentonite hydration. Subsequent to well installation, a protective steel casing with locking cap will be placed over each well and will be securely set in concrete. Holes will be drilled into the sides of the base of the steel casing to allow for drainage.

Drilling equipment and associated tools, including augers, drill rods, sampling equipment, wrenches, etc., having contacted potentially impacted materials will be decontaminated using a portable pressurized steam-cleaning unit. Split-barrel samplers will be cleaned using a detergent (Alconox type) wash and clean water rinse after each sampling effort.

Subsequent to installation, the new monitoring wells will be developed using bailer or low-yield pumping methods. Each well will be developed until a relatively sediment-free ground water sample can be obtained. Following well installation and development, a field instrument survey will be performed by a registered surveyor to establish the location, top of casing elevation, and ground elevation for the newly installed monitoring wells.

For reference, copies of the boring logs and well construction details for the current monitoring well network are included in the SAP as Appendix B.

As required in Special Permit Condition II.D.5., the MDNR will be notified at least five days in advance of conducting well abandonment or new well installation. New monitoring wells will be sampled no later than the next regularly scheduled sampling event following installation.

#### **2.4. 5-yr sampling event**

As described in Special Permit Condition II.E.7, five years after the issuance of the permit, two ground water monitoring wells historically exhibiting impact will be sampled for 40 CFR 264, Appendix IX volatile organic compounds (VOCs). The analyses will be used to evaluate if additional constituents are detected that may be attributed to the former impoundment. If additional constituents are detected and confirmed by additional sampling, a Class 1 permit modification will be proposed in accordance with 40 CFR 270.42. The modification will propose the addition of the new hazardous constituents to the compliance monitoring program.

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### 3. Compliance monitoring program sampling procedures

#### 3.1. Ground water sampling schedule

Ground water monitoring wells shall be sampled in accordance with the schedule in Special Permit Condition II.E., Table II. Analytical detection limits will achieve the limits listed in Table I of the permit. Ground water laboratory analytical parameters are:

Cadmium (Cd)	Chromium (Cr) III
Chromium (Cr) VI	Cyanide (CN)
Lead (Pb)	Manganese (Mn)
Mercury (Hg)	Nickel (Ni)
Zinc (Zn)	

The concentration of chromium III will be calculated by subtracting the concentration of chromium VI from the total chromium concentration. pH, specific conductance, static ground water elevation, temperature, and total well depth will be measured in the field.

The ground water monitoring wells will be sampled according to the schedule below:

<u>Well ID</u>	<u>Frequency</u>	<u>Well ID</u>	<u>Frequency</u>
GMW #2S	Semi-annually	GMW #6S	Annually
GMW #2D	Semi-annually	GMW #6D	Annually
GMW #3	Semi-annually	GMW #7	Annually
GMW #3S	Semi-annually	GMW #9	Annually
GMW #3D	Semi-annually		
GMW #4S	Semi-annually		
GMW #4D	Semi-annually		
GMW #5S	Semi-annually		
GMW #5D	Semi-annually		

Appendix IX, 40 CFR 264, VOC analysis will be performed every five years. Samples for Appendix IX analysis will be collected from GMW #4S and GMW #4D.

### **3.2. Pre-sampling procedures**

As part of each sampling event, the following steps will be taken by personnel responsible for sampling:

- Review the sampling procedures and Health and Safety Plan as outlined in Appendix C.
- Obtain appropriate containers for sample collection. The type and quantities of containers will be identified based on the laboratory analyses to be performed as outlined on the chain of custody form contained in Appendix D.
- Examine sampler, bottles, and preservatives; contact laboratory immediately if any problems are discovered.
- Confirm sample delivery time and method of sample shipment with the laboratory.
- Assemble and inspect field equipment to be used for sample collection; verify that equipment is clean and in proper working order.
- Calibrate field instruments and/or meters to manufacturer's specifications. Specific conductivity, pH, and turbidity meters will be calibrated to known calibration standard solutions. Re-check calibration prior to sampling each well. Calibration activities will be recorded on the Ground Water Sampling Field Log.
- Establish well location and well identification.
- Obtain necessary keys for wells or gates.
- Examine each well for damage, tampering, erosion around the well casing, etc., and note on the Ground Water Sampling Field Log.

- Place clean plastic sheeting around the well to provide a barrier between the surrounding ground surface and sampling equipment used.
- Decontaminate water level indicators and measuring tapes used in the well by thoroughly wiping with a distilled water-soaked, clean paper towel. Rinse with distilled water.
- Open the well cap and make a visual check down the casing, noting the condition of the well casing and whether a permanent ground water level reference point has been established on the casing. Note observations on the Ground Water Sampling Field Log.

### **3.3. Water level measurements**

Prior to initiating ground water sampling, water elevations will be measured in each of the wells and the four piezometers on-site. Ground water level measurements will be collected as follows:

- A graduated measuring tape will be used to measure the depth to water from the top-of-casing reference point. Record the depth on the Ground Water Sampling Field Log. This procedure will also be used to measure the depth of the well. Measurements shall be made to the nearest 0.01 ft.
- After establishing the water level, the volume of water within the well will be calculated.

### **3.4. Record keeping**

Prior to initiating the well purging process, the following information should be recorded in a field log book and/or on the Ground Water Sampling Field Log:

- Well number
- Day/date/time
- Weather conditions
- Condition of the well and surrounding area
- Sampling team members

- Instrument calibration information
- Water level prior to purging
- Depth to the bottom of the well
- Volume of water to be purged
- Physical properties of evacuated water: color, odor, turbidity, presence of non-aqueous phase liquids
- Deviations from planned sampling methodology.

### **3.5. Labels**

Sampling jar labels should be filled out to include:

- Sample number identification
- Initials of sampler
- Date and time sample collected
- Analytical parameters
- Site location
- Preservative
- Client name.

### **3.6. Purging the well**

Prior to sampling, the wells will be purged to remove the standing water column from the well casing. Where recharge is sufficient, a minimum of three well volumes of water will be removed from each well. A well volume of water is calculated using the following formula:

$$V = (0.49)(h)(r^2)$$

where:

- $V$  = standing water volume in gallons to be purged
- (0.49) is a correction factor which includes conversion from inches to feet and the fact that three volumes are to be purged

- $h$  = linear feet of standing water in the casing
- $r^2$  = inside radius of well in inches, squared.

#### 3.6.1. Bailer method

- Attach a new, clean length of dedicated polypropylene rope to the dedicated bailer. Lower the bailer to the bottom of the well and agitate the bailer up and down to suspend fine-grained materials settled in the well, thereby facilitating the removal of these materials.
- Initiate bailing the well from the well bottom. Ground water should be poured from the bailer into a graduated pail to measure the quantity of water removed from the well.
- Continue bailing the well throughout the water column and from the bottom until a sufficient volume of ground water in the well has been removed or until the well is bailed dry. If the well is bailed dry, allow sufficient time for the well to recover before proceeding with the next step. Record this information on the Ground Water Sampling Field Log.
- In wells which exhibit sufficient recharge, pH, specific conductance, and temperature measurements will be collected from the initial bailer of ground water and after removing each well volume. Purging will continue until two of the well volume measurements are within  $\pm 10\%$  of the preceding value over two successive well volumes and after at least three total well volumes have been removed. Record this information on the Ground Water Sampling Field Log.
- The water removed during purging or possible decontamination procedures will be discharged to the Laclede Chain Company wastewater pretreatment system.

#### 3.7. Sampling protocols

Each well will be sampled according to the following procedures:

- Remove the sampling bottles from their transport containers and prepare the bottles for receiving samples. Inspect all labels to facilitate proper

sample identification. Sample bottles will be kept cool with their caps on until they are ready to receive samples.

- To minimize agitation of the water in the well, initiate sampling by lowering the dedicated bailer slowly into the well, making certain to submerge it only far enough to fill it completely.
- If the sample bottle cannot be filled quickly, it will be kept cool with the cap on until it is filled. Sample containers will be preserved appropriately (nitric acid for metals and sodium hydroxide for cyanide).
- Return each sample bottle to its proper transport container. Preserve samples by reducing the temperature within the containers to approximately 4° Celsius using blue ice or wet ice. Samples must not be allowed to freeze.
- When samples are to be split with the regulatory agency or other party, each bailer-full of water should be split between both parties' jars, one jar type at a time.
- Record the physical appearance of the ground water observed during sampling on the Ground Water Sampling Field Log.
- Replace the well cap and lock the well protection assembly before leaving the well location.
- Begin the chain of custody record (Appendix D).

To make more efficient use of sampling time, monitoring wells that are purged and sampled prior to 12:01 p.m. will not have their hexavalent chromium sample collection until after 12:01 p.m. of the same day. This will allow as much time as possible for the samples to be delivered to the laboratory within the hexavalent chromium 24-hr holding time and will allow the sampler to complete the day's sampling early enough to deliver the samples to the overnight delivery service. It will not be necessary to remove additional quantities of water from the ground water monitoring wells prior to collecting the hexavalent chromium samples.

### 3.8. Sample control and chain of custody

- For proper identification in the field and proper tracking in the laboratory, samples will be labeled in a clear and consistent fashion.
- Sample labels will be waterproof, or sample jars will be sealed in plastic bags.
- Field personnel will maintain a sampling log sheet.
- The sampling field log sheets will contain sufficient information to allow reconstruction of the sample collection and handling procedures at a later time.
- Each ground water monitoring well will have a corresponding sample log sheet which includes:
  - Sample identification number
  - Well location and number
  - Date and time
  - Sampler's name
  - Sample type (composite or grab)
  - Analysis for which sample was collected
  - Field parameters including pH, temperature, and specific conductance
  - Method of preservation
  - Additional comments as necessary.
- Each sample will have a corresponding entry on a chain of custody record (Appendix D). The record will include:
  - Site name
  - Sample identification number
  - Sample type (*i.e.*, water, soil, sludge)
  - Date and time of collection
  - Number and type of containers
  - Preservatives
  - Required analyses
  - Signature block for custody transfer.

### **3.9. Sample containers**

Sample containers will be pre-cleaned and contaminant-free. The lab jar supplier will have pre-cleaned the sampling jars according to USEPA-approved cleaning methods. The analytical lab purchases the pre-cleaned bottles from a reputable laboratory supply vendor. Sample containers will be pre-preserved by the lab.

### **3.10. Sampling waste disposal**

During ground water sampling, potentially impacted sampling equipment (glassware) and disposable supplies (plastic sheeting, rope, latex gloves, and paper towels) will be generated. Broken glassware will be rinsed with distilled water, placed in plastic bags, and disposed in the Laclede Chain general refuse container. The rinse water will be contained in a bucket and disposed of in the Laclede Chain wastewater pretreatment plant. Disposables will be placed into plastic trash bags and placed into the Laclede Chain general refuse container for disposal. Clothing that has been splashed with ground water will be placed into plastic bags at the end of the sampling event. The clothing can be washed as long as the splashed clothing is segregated and washed separately from normal laundry. If disposable coveralls are worn, they will be placed into plastic bags and placed into the Laclede Chain general plant refuse container for disposal.

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## **4. Field quality assurance/quality control procedures**

### **4.1. Quality assurance/quality control (QA/QC) protocols**

To evaluate quality assurance (QA) and quality control (QC), a field blank and a field duplicate sample will be collected.

The field blank shall be created in the field by filling each type of sampling container that will be used for samples with distilled water and labeled as an additional ground water monitoring well. The field blank will accompany the other containers at the site and be handled as a sample. Field blanks will be analyzed for the same suite of parameters as the samples.

A field duplicate sample shall be collected in the field by filling a second set of each type of sampling container with ground water from a ground water monitoring well and labeled with the ground water monitoring well number from which the sample was collected, followed by the letter "A." For example, a duplicate from GMW #3 will be labeled as GMW #3A. The field duplicate sample will be shipped to a different laboratory for analyses. The field duplicate sample will be analyzed for the same suite of parameters as the ground water samples.

### **4.2. Analytical procedures**

Laboratory procedures, detection limits, container types, maximum holding times, and chemical preservatives for the parameters of interest are listed below:

## Ground Water Sampling and Analysis Plan

Parameter	Maximum detection limit (mg/L)	USEPA method	Container type	Maximum holding time	Chemical preservative
Total cyanide (CN)	0.005	SW412D	Polyethylene	14 days	NaOH to pH 12
Total cadmium (Cd)	0.005	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Total chromium (Cr)	0.005	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Chromium III (Cr <sup>III</sup> )	0.005	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Chromium VI (Cr <sup>VI</sup> )	0.005	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Total lead (Pb)	0.002	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Total manganese (Mn)	0.005	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Total mercury (Hg)	0.0002	SW7470	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Total nickel (Ni)	0.005	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2
Total zinc (Zn)	0.010	SW6010	Polyethylene	6 months	HNO <sub>3</sub> to pH 2

Total cyanide will be analyzed from one 500 milliliter (mL) sample container. Total lead, zinc, manganese, and nickel will be analyzed from a separate 500 mL sample container. Hexavalent chromium will be analyzed from a separate 500 mL sample container. Total cadmium, chromium, and mercury will be analyzed from a 1 liter sample container. A total of four sample containers will be filled from each ground water sampling location.

When analyzing samples by the above standardized methods, the accuracy or precision of the data generated by the laboratory will be assessed through analysis of replicates and field or laboratory blanks along with each set of samples.

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## **5. Laboratory QA/QC procedures**

It is intended that American Technical and Analytical Services, Inc. (ATAS) of Maryland Heights, Missouri will be performing the laboratory analytical work for the ground water samples collected. They reportedly have an extensive QA/QC program, following the procedures established in SW846, as well as those outlined in the following sections and illustrated on Figure 3.

### **5.1. Inter- and intra-laboratory programs**

The laboratory participates in inter-laboratory programs through the certification programs of various states. Intra-laboratory programs include the analysis of duplicates, spikes, surrogate spikes, and reference samples. This information will be provided along with the regular quarterly ground water data submittals.

In quality control, "precision" means the agreement within a set of replicate results. Precision is described in terms of deviation, variance, or range. The term "accuracy" refers to the nearness of the analytical results to the true value. It is described in terms of error, bias, or percent recovery. Together with the samples analyzed in the laboratory, the staff uses duplicate samples, spiked samples, blanks, and samples with a predetermined concentration of the parameter called the "reference standard" to judge precision and accuracy.

A "spiked sample" is one which has a specific amount of the parameter added to a sample already analyzed. The accuracy of an analytical method is established by the recovery of the analyte from the sample matrix. Following analysis of the spiked sample, the technician records the total amount of the parameter. The concentration of the parameter that is found in the spiked sample is used to calculate recoveries which are compared to the control limits in the database. Analyses found within the control limits are accepted as valid. If the value is found to be beyond these limits, the analysis will be rejected and the sample will be re-analyzed.

A sample can be split, and multiple analyses can be performed. These are "laboratory duplicate samples," and they indicate the precision of the analytical method -- the ability to reproduce a result while performing any given procedure.

Many samples are analyzed in the presence of reagents. A "blank" sample is distilled water into which the reagents have been added. In analyzing a blank, no detected concentration of the parameter should be measured. If the parameter is measured, the analysis is deemed contaminated. Whenever contamination is found through the analysis of blanks, the laboratory searches for its source. Detected contamination is recorded, and those records are used to correct analytical values or, if necessary, to reject a set of analyses.

## **5.2. Error detection**

There are two categories of error which may occur in analytical programs -- systematic and random. Systematic errors are caused by an incorrect or faulty procedure; these errors produce inaccurate results. With a rigorous QA/QC program, these errors are detected, and the analyst is able to make the necessary corrections.

There can be many causes of random errors, and they may relate to the skill of the analyst. Random errors affect precision more than they affect accuracy, and they are difficult to correct. The QC program can assess the magnitude of error, and it can assign a level of confidence to the data. A low level of confidence indicates a need for additional training of the analyst.

## **5.3. Laboratory equipment decontamination**

The lab performs normal maintenance and cleaning of its laboratory equipment on a daily basis. These activities are performed according to the manufacturer's recommendations. Contaminated laboratory equipment would be detected in the analysis of the method blanks. To address detected concentrations in the method blanks, the laboratory re-analyzes the entire batch after the equipment has been systematically cleaned.

#### 5.4. Data management

The data gathered in the laboratory's QA/QC program result in a large number of records. The laboratory employs the methods described below to order and analyze the data. This system facilitates the documentation of each step of sample handling. The day-to-day efforts of the QA/QC program build a "QA/QC model." This model provides detailed control charts and control limits which measure the performance of the laboratory daily. Examples of control charts are listed on Figures 3 and 4; the daily quality control efforts to ascertain quality assurance are summarized on Figure 5.

The data management system begins to track a sample as it enters the laboratory. Each sample is tagged with a unique identification number. A computer-managed coding format is used to categorize samples. This format can be adapted to every analytical investigation. It then serves as the basis for storage and retrieval of data.

Any measurement which is made repeatedly will display a number of different results. Because not all the measurements are likely to be the same, they will be distributed typically close to the mean or average. The overall distribution of results will be that of the normal distribution with the familiar bell shape. The QA/QC program monitors the mean and the standard deviation from the mean. Control limits (Figures 4 and 5) are calculated at three standard deviations from the mean (99.9% confidence level of the normal distribution).

As quality control data are collected, the exact distribution of the data is established. Statistical methods evaluate the quality of the data by calculating control limits and warning limits for each parameter by matrix. The warning limit is defined as two standard deviations on either side of the mean; this provides a 95% confidence level. The control limit refers to an interval of three standard deviations on either side of the mean and provides a confidence level of 99.9%.

An analyst in the environmental laboratory may examine the quality control database at any time. The analyst may check the percent recovery, duplicate ratios, percent of reference standard, and a blank value against the most recent mean, standard deviation, and control limits which have been calculated for each database. Thus, the analyst can assess whether the values found are within an acceptable range.

### **5.5. Daily record**

On a daily basis, the QA/QC program manages data which monitor laboratory analyses of duplicate and spiked samples and synthetic knowns. The leader of the QA/QC group reviews the statistical programs which monitor these analyses daily. The leader checks the most recent database in the computer. Therefore, the leader can know whether the analytical method's performance is within acceptable ranges and can decide whether to accept, reject, or repeat the analyses.

Each day the QA/QC group leader is able to review a report containing information on the quality control samples. The sample number, test parameter, quality control sample type, date of analysis, percent recoveries, relative errors, and warning and control limits are shown on this report. The QA/QC group leader is thus able to examine these data each day and evaluate acceptability. A scan of the sheet can tell the status of unfinished samples and the values of quality control data entering databases.

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## 6. Reporting requirements

The Annual Ground Water Compliance Monitoring Report will comprehensively address the technical requirements of 40 CFR 264 Subpart F and the Permit. The report will be submitted to MDNR by March 1 of each calendar year for the preceding calendar year. The report will discuss the evolution of the ground water monitoring program and an evaluation of the adequacy of the program related to its intended purpose. The report will summarize relevant ground water monitoring information in the form of discussions, ground water flow calculations, and diagrammatic illustrations. The report will include, but not be limited to:

- Field parameter measurements
- Copies of field sampling logs
- Ground water analytical reports
- Well repair documentation, if applicable
- QA/QC documentation
- Other relevant ground water information
- Tabulated ground water elevation data
- Comparison of analytical data to Permit Ground Water Protection Standards
- Ground water potentiometric maps
- Chemical concentration trend graphs
- Evaluation of the rate and direction of ground water flow
- Evaluation of the horizontal and vertical extent of hazardous constituents
- Evaluation of surface and subsurface well integrity
- Quantity of ground water purged from each well and total purged
- Boring logs for new borings
- Ground water monitoring well diagrams for new ground water monitoring wells.

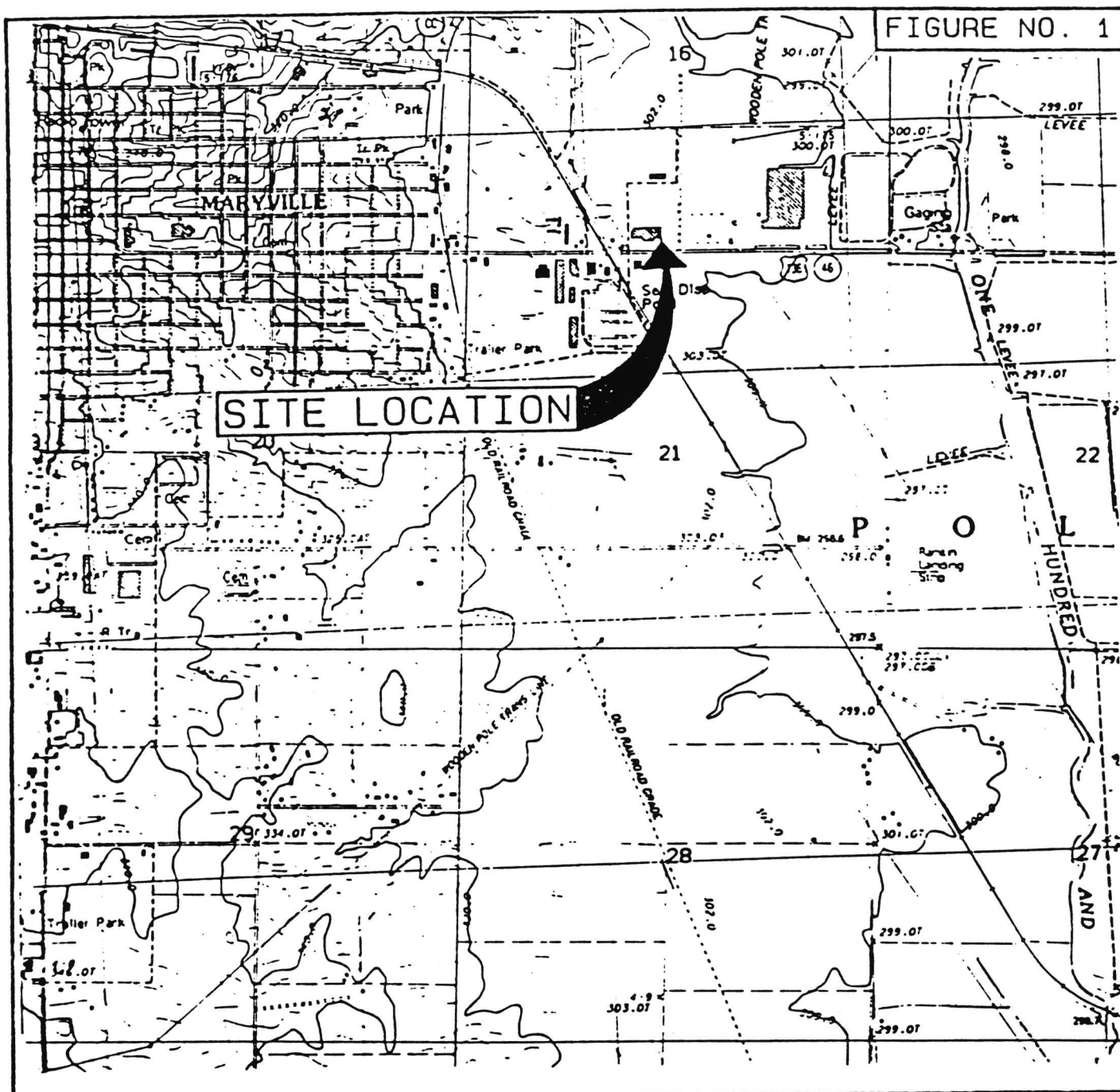


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## **7. Flood contingency**

A contingency plan for the inspection of wells contacted by flood waters should not be necessary since the site is not in a 100-yr flood plain.





# NIXDORFF-LLOYD CHAIN COMPANY MARYVILLE, MISSOURI

## TOPOGRAPHIC SITE LOCATION MAP



ADAPTED FROM U.S.G.S. (7.5 MIN)  
MARYVILLE EAST QUADRANGLE  
MISSOURI-NODAWAY CO.: 1985  
SCALE 1" = 2,000'  
CONTOUR INTERVAL 4 METERS



BLANK SITE MAP

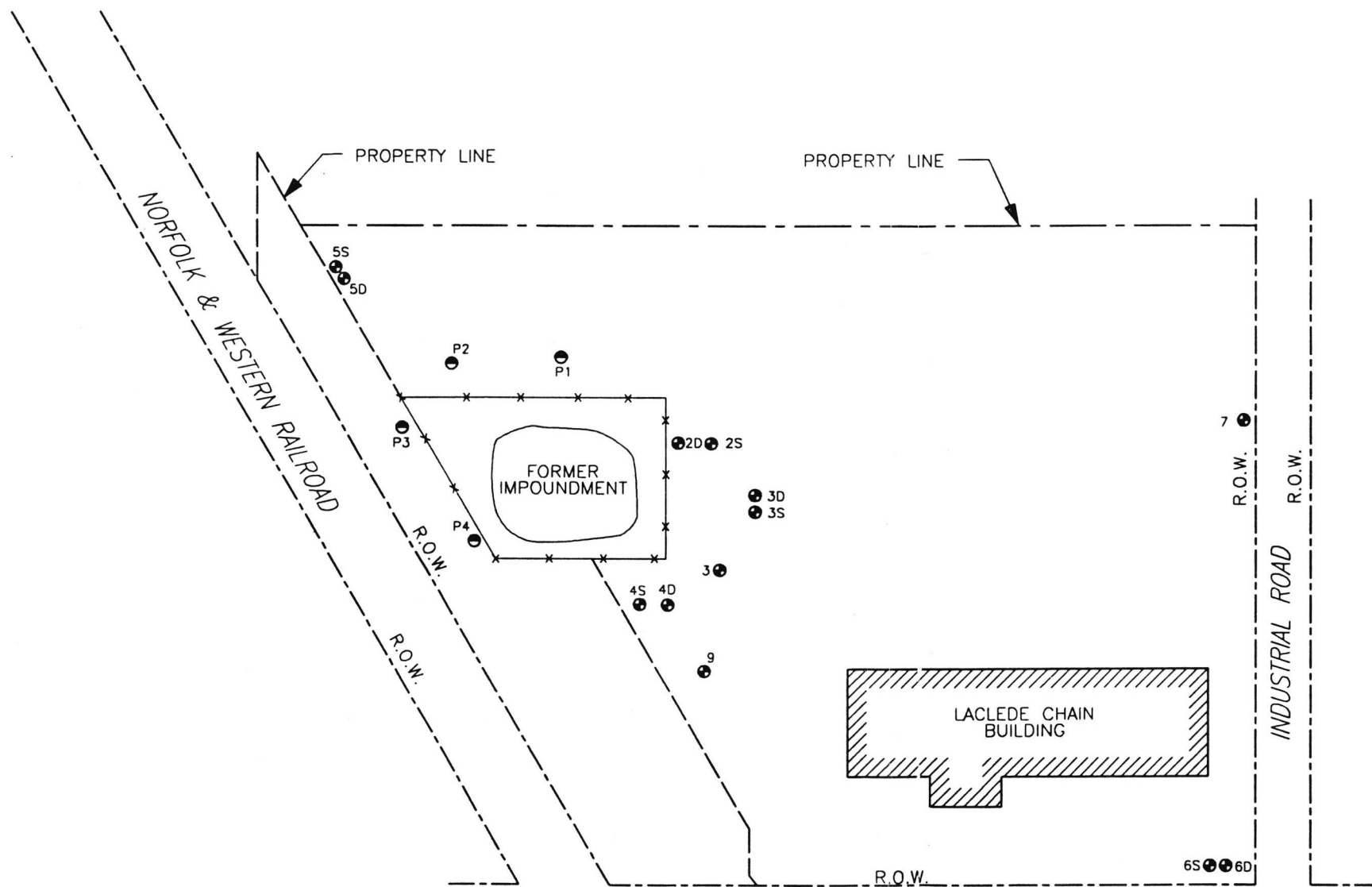


FIGURE 2



LEGEND

- GROUND WATER MONITORING WELL
- PIEZOMETER

NIXDORFF LLOYD  
CHAIN COMPANY  
MARYVILLE, MISSOURI

GROUND WATER  
MONITORING WELL  
LOCATION PLAN

FIGURE 3

# DECISION MAKING PROCESS FOR QA/QC PROTOCOL AND ANALYSIS OF SAMPLES

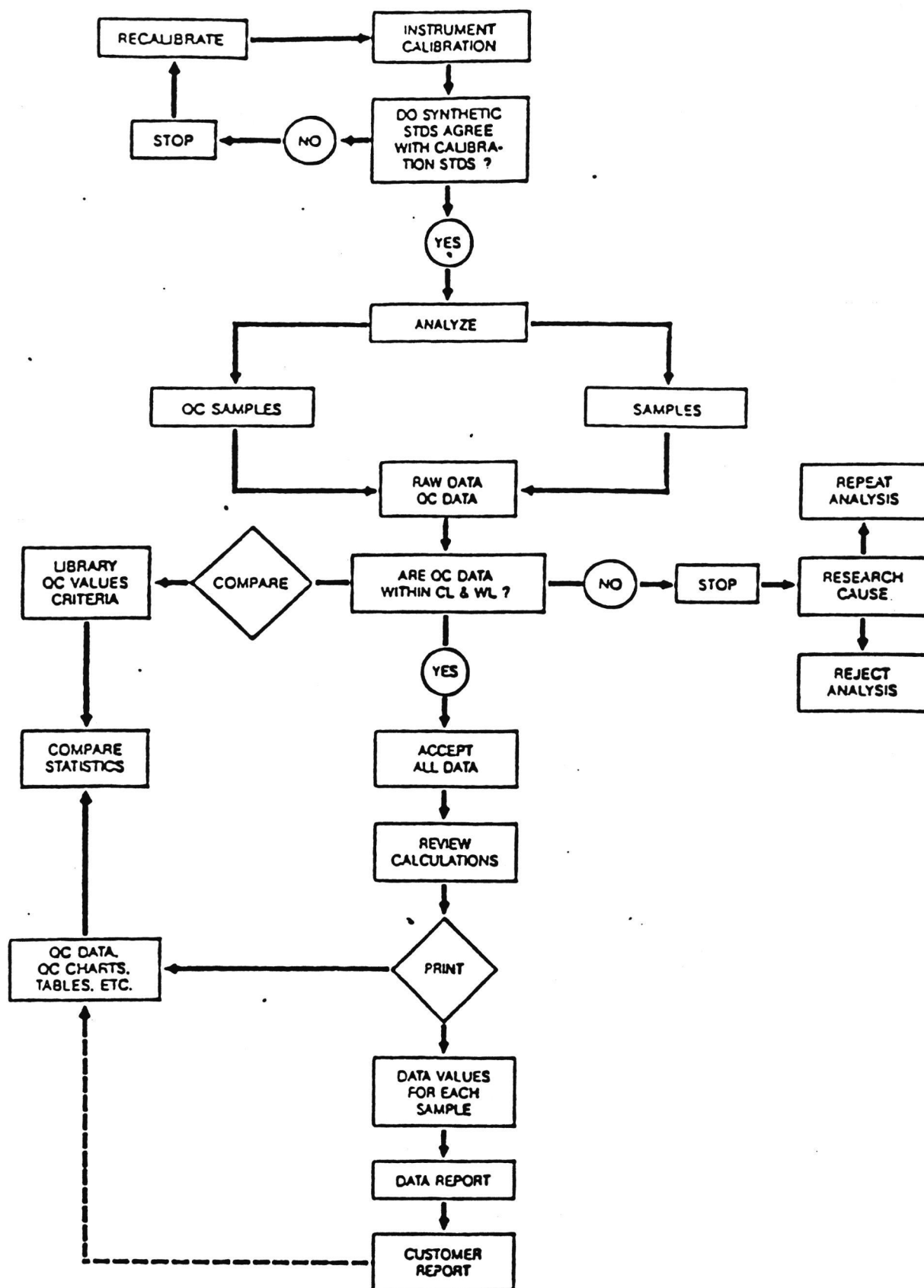
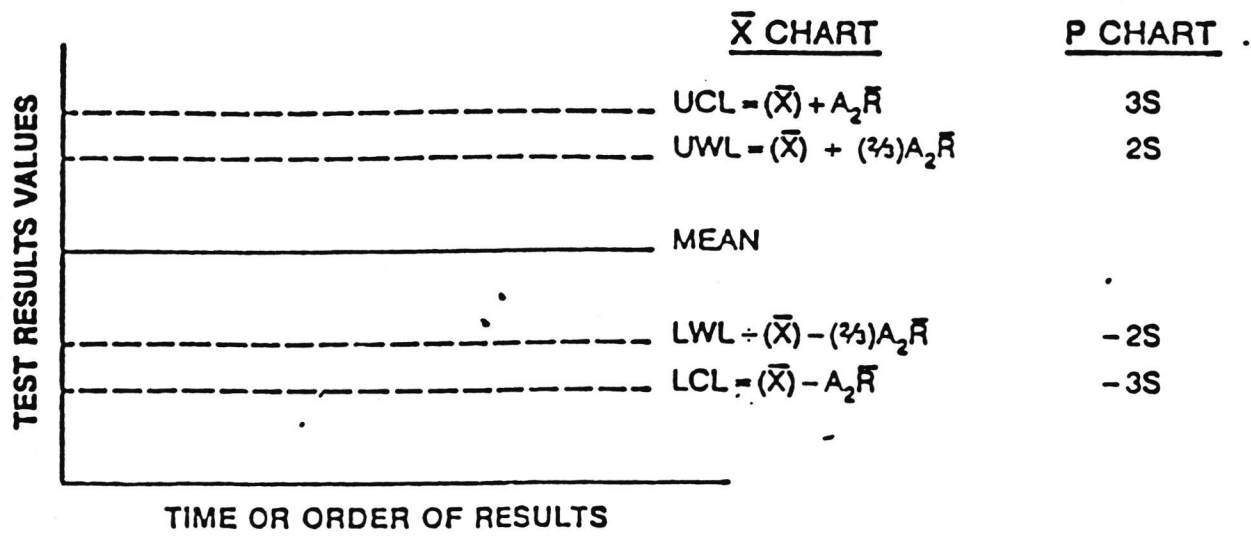
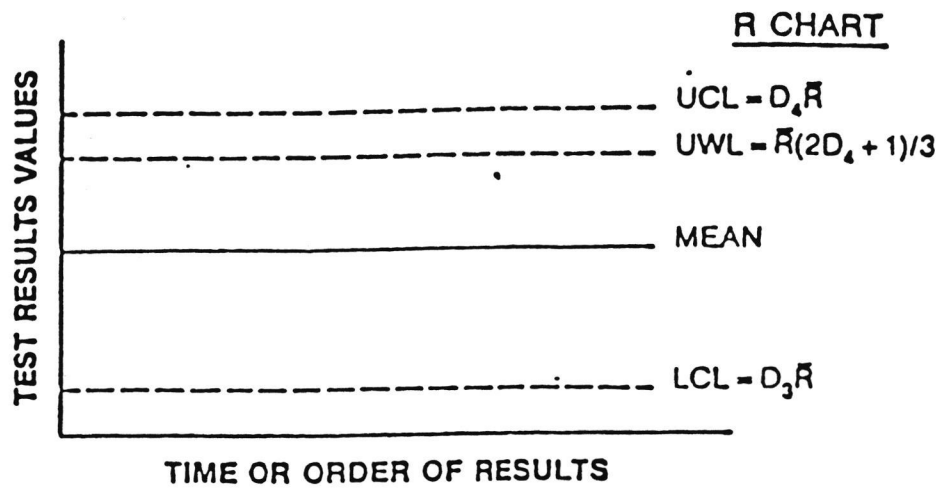


FIGURE 4

ESSENTIALS OF CONTROL CHARTS



# SPIKED RECOVERY CONTROL CHART

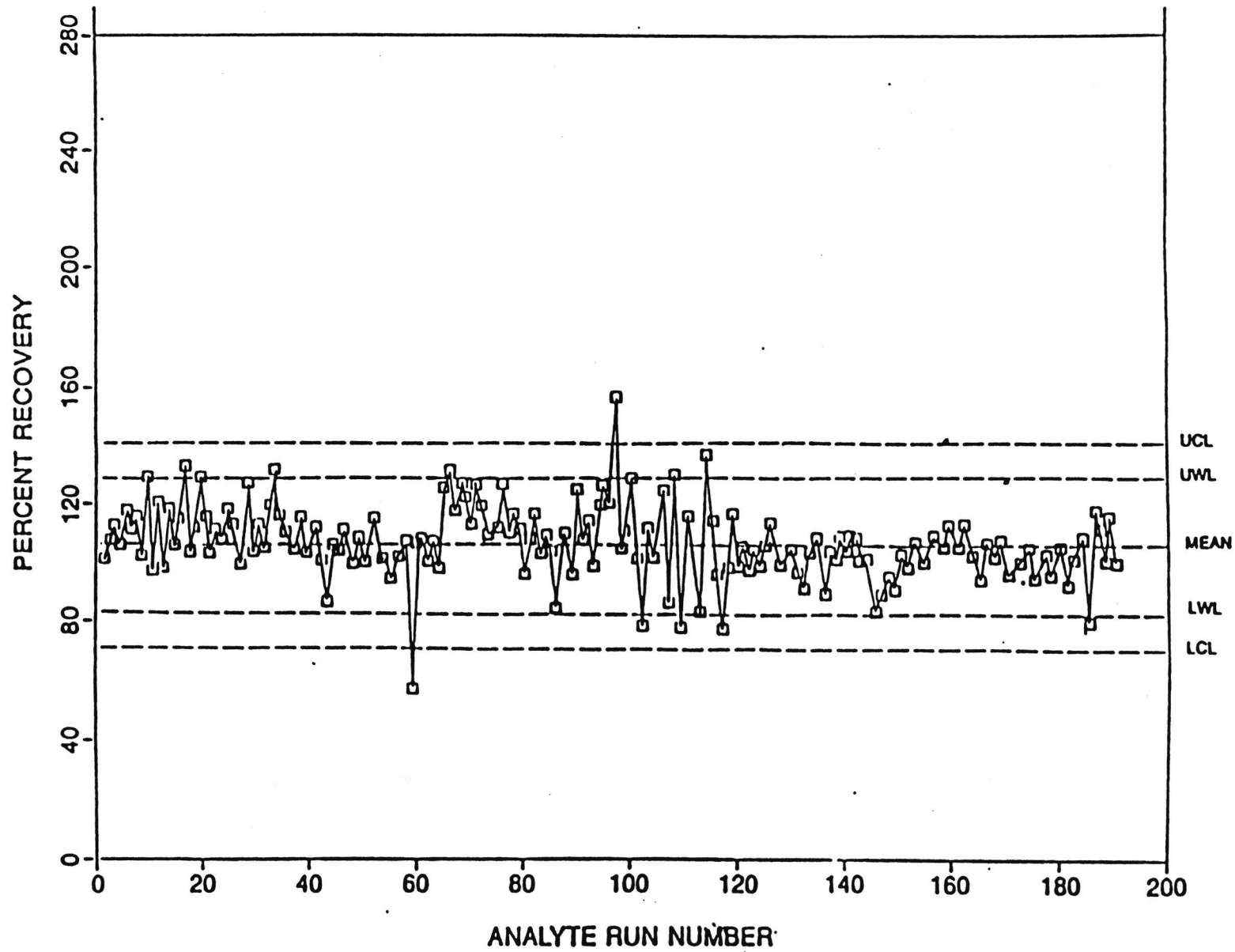


FIGURE 5

## **Appendix A**

### **Ground water sampling field log with monitoring well checklist**

Date: \_\_\_\_\_  
 Site Name: \_\_\_\_\_  
 Site Location: \_\_\_\_\_  
 Personnel: \_\_\_\_\_

Weather: \_\_\_\_\_  
 Well Number: \_\_\_\_\_  
 Project Number: \_\_\_\_\_  
 Evacuation Method: \_\_\_\_\_

Depth of Well \* \_\_\_\_\_ ft.  
 Depth to Water \* \_\_\_\_\_ ft.  
 Length of Water Column \_\_\_\_\_ ft.  
 Volume of Water in Well \_\_\_\_\_ gal.(s)  
 3X Volume of Water in Well \_\_\_\_\_ gal.(s)

Water Volume /ft. for:

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

6" Diameter Well = 1.469 X LWC

Volume removed before sampling \_\_\_\_\_ gal.(s)  
 Did well go dry? Yes \_\_\_\_\_ No \_\_\_\_\_

\*Measurements taken from ☐ Top of Well Casing ☐ Top of Protective Casing ☐ (Other, Specify) \_\_\_\_\_

Water parameters:

## Temperature Reading

initial \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_

## pH Reading

4.0 Standard \_\_\_\_\_  
 7.0 Standard \_\_\_\_\_  
 10.0 Standard \_\_\_\_\_  
 initial \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_

## Conductivity Reading

84 S Standard \_\_\_\_\_  
 1413 S Standard \_\_\_\_\_  
 initial \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_  
 after \_\_\_\_\_ (gal.) \_\_\_\_\_

Water Sample:

Time Collected: \_\_\_\_\_

## Physical Appearance at Start

Color \_\_\_\_\_  
 Odor \_\_\_\_\_  
 Turbidity (> 100 NTUs) \_\_\_\_\_  
 Sheen/Free Product \_\_\_\_\_

## Physical Appearance at Sampling

Color \_\_\_\_\_  
 Odor \_\_\_\_\_  
 Turbidity (> 100 NTU's) \_\_\_\_\_  
 Sheen/Free Product \_\_\_\_\_

Sample Parameters:

Container Size	Container Type	# Collected	Filtered	Preservative	pH	Temp.	Conductivity

## Monitoring Well Integrity Checklist:

Well identification number clearly marked?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Well covers and locks in good condition and secure?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Is the well stand pipe vertically aligned and secure?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Is the concrete pad and surface seal in good condition?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Are soils surrounding the well pad eroded?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Is the PVC well casing in good condition?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Is there standing water in the annular space between the well stand pipe and PVC casing?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Is the stand pipe vented at the base to provide drainage?.....Yes \_\_\_\_\_ No \_\_\_\_\_  
 Does the total depth of the well sounded correspond with original well completion depths?.....Yes \_\_\_\_\_ No \_\_\_\_\_

NOTES: Top of casing elevation: \_\_\_\_\_  
 Depth to Ground Water: \_\_\_\_\_  
 Ground Water Elevation: \_\_\_\_\_

## **Appendix B**

### **Boring log and well construction details**



# KANSAS CITY TESTING LABORATORY

## FOUNDATION TESTS FOR:

Nixdorff-Lloyd Chain Co.

## TEST BORING LOG

Building Site: Monitoring Well Installation

Location: Maryville, MO

Date: 6-28-82

Boring No.: B1 Location: see sketch

Scale: 1 inch = 3 feet

Log	Elevation	Depth in Feet	Description	No. of Blows	Depth Inche
		0.0	DARK BROWN SILTY CLAY (CL)		
		1.5	LIGHT BROWN SILTY CLAY MOIST, STIFF (CL)		
		8.1	SAME MATERIAL		
		12.0	TAN SILTY CLAY VERY STIFF, SOME SAND (CL)		
			FREE WATER ENCOUNTERED AT 13.0'		
		20.0	TERMINATION OF BORING WATER LEVEL AT 8.1' UPON COMPLETION OF BORING		



# KANSAS CITY TESTING LABORATORY

FOUNDATION TESTS FOR:

Nixdorff-Lloyd Chain Co.

TEST BORING

Building Site: Monitoring Wall Installation

Location: Maryville, MO

Date: 6-28-82

Boring No.: B2

Location: see sketch

Scale: 1 inch = 3

Log	Elevation	Depth in Feet	Description	No. of Blows
		0.0	TOPSOIL DARK GRAY CLAYEY SILT MOIST, LOOSE	
		2.0	BROWN SILTY CLAY MOIST, STIFF (CL)	
		8.0	LIGHT BROWN SANDY CLAY MOIST, MEDIUM, STIFF (CL)	
	▽	12.0	GRAY SANDY CLAY MOIST, STIFF (CL) FREE WATER ENCOUNTERED AT 12.5'	
		15.0	BROWN CLAYEY SAND WET, MEDIUM, STIFF (SC)	
		20.5	TERMINATION OF BORING WATER LEVEL AT 12.0' UPON COMPLETION OF BORING	



# KANSAS CITY TESTING LABORATORY

FOUNDATION TESTS FOR:

Nixdorff-Lloyd Chain Co.

TEST BORING 1

Building Site: Monitoring Wall Installation

Location: Maryville, MO

Boring No.: B3

Location: see sketch

Date: 6-28-82

Scale: 1 inch = 3 feet

Log	Elevation	Depth in Feet	Description	No. of Blows	De Inc
		0.0	TOPSOIL DARK GRAY CLAYEY SILT MOIST, LOOSE		
		2.0	BROWN SILTY CLAY MOIST, MEDIUM STIFF TO STIFF (CL)		
		8.5	GRAY SILTY SANDY CLAY MOIST, STIFF (CL)		
	▽ 12.0	12.0	SAME MATERIAL		
		13.0	BROWN CLAYEY SAND WET, MEDIUM STIFF (SC) FREE WATER ENCOUNTERED AT 13.0'		
		17.0	BROWN FINE TO MEDIUM SAND WET, LOOSE (SP)		
		20.5	TERMINATION OF BORING WATER LEVEL AT 12.0' UPON COMPLETION OF BORING		



# KANSAS CITY TESTING LABORATORY

FOUNDATION TESTS FOR:

Nixdorff-Lloyd Chain Co.

TEST BORING LOG

Building Site: Monitoring Well Installation

Location: Maryville, MO

Date: 6-28-82

Boring No.: B4

Location: see sketch

Scale: 1 inch = 3 feet

Log	Elevation	Depth in Feet	Description	No. of Blows	Depth Inches
		0.0	FILL DARK BROWN SILTY CLAY WITH GRAVEL		
		1.0	GRAY SILTY CLAY MOIST, STIFF (CL)		
		8.0	LIGHT BROWN SILTY CLAY WITH TRACE OF SAND MOIST, MEDIUM, STIFF (CL)		
	▽	12.0	SAME MATERIAL		
		15.0	DARK GRAY SANDY CLAY MOIST, VERY STIFF (CL) FREE WATER ENCOUNTERED AT 15.0'		
		20.5	TERMINATION OF BORING WATER LEVEL AT 12.0' UPON COMPLETION OF BORING		







O'BRIEN & GERE  
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No. Xd 2s,  
Sheet 1 of 1

Project Location  
Marionville, Missouri  
Client:  
Nixdorf-Lloyd Chain Company

Type:  
Hammer:  
Fall:

SAFLEER

Ground Water Depth      Date  
Depth - Date -

File No. 3050.005

Boring Co. Omaha Testing Division - P.S.I.  
Foreman: Scott Kratz  
GSG Geologist: Peter Bogardus

Boring Location: Mw 2s, 2d  
Ground Elevation:  
Dates: Started: 11/6/85

Ended:

Depth	Sample		Blows /6"	Sample Description	Stratum Change General Descript	Equipment Installed	
	Peretrm/ Recovery	Depth					
0'	1	0-1.5	3-4-5	Gray, moist, SILT, some fine Sand, trace Clay			
5'	2	5-5.5	3-4-5	Gray-green, moist, SILT, some Clay, trace fine Sand. (iron oxide stains)			
10'	3	10-11.5	2-2-3	Red-brown, moist, SILT, some Clay, trace fine Sand. (iron oxide stains)			
15'	4	15-16.5	5-8-12	Red-green, moist, SILT and FINE SAND, little Clay. (iron oxide stains)			
20'	5	20-21.5	6-6-4	Gray, wet, FINE SAND			
25'	6	25-26.5	7-13-13	Gray, wet, FINE to COARSE SAND, little fine Gravel			
30'	7	30-31.5	6-7-10				
35'	8	35-36.5	SHELLY	Gray-black, moist, CLAY, some Silt, trace coarse Sand			



OBRIEN &amp; GERE

## TEST BORING LOG

BORING NO. 35 SHT. 1 OF 2

## PROJECT LOCATION:

Maryville, Missouri.

CLIENT: M. &amp; H. Lloyd Chain Co

BORING CO: PSI - Omaha

FOREMAN: Gary Loughlin

BG GEOLOGIST: Dave C. Ko

## SAMPLER

TYPE: ASTM D 1586 - 84

HAMMER: 140 lbs

FALL: 30"

## GROUND WATER

DEPTH

DATE

ELEV.

DEPTH

DATE

ELEV.

FILE NO: 3050.005

RIG: CME-SS

BORING LOCATION: Southeast of Lacey

GROUND ELEVATION: 994.6 TOC: 97.57

DATES: STARTED: 6-16-89

ENDED: 6-16-89

## SAMPLE

## SAMPLE DESCRIPTION

STRATUM  
CHANGE  
DEPTH

## FIELD TESTING

SAL

SP.

HNU

NO. (Feet) DEPTH BLOWS PEN/ REC. "N" VALUE

1 0.0-1.5 2

4

7

3" topsoil over fill - medium to dark gray clayey silt, trace to some fine sand, trace crushed rock - damp to moist

Fill

2 3.5-5.0 3

4

8

Apparent end of fill at 4.5'

Medium gray to green gray silty clay, some rust colored staining, trace fine sand - moist

CL

3 8.5-10.0 2

3

6

Medium brown and gray silty clay, occ reddish brown, some rust colored staining, trace fine sand - moist

Becoming wet

4 13.5-15.0 3

3

4

Medium brown and gray silty clay with some rust colored staining, trace to some fine sand - moist to wet

RECEIVED  
AUG 14 1989W. J. O'BRIEN & GERE  
ENGINEERS



O'BRIEN &amp; GERE

## TEST BORING LOG

BORING NO. 35 SHT. 2 OF 2

GROUND WATER

DEPTH	DATE	ELEV.
DEPTH	DATE	ELEV.

FILE NO: 3050.005

## PROJECT LOCATION:

Maryville, Missouri

CLIENT: Nixdorf &amp; Lloyd Chair Co

## SAMPLER

TYPE: ASTM D 1586-84

HAMMER: 140 lbs.

FALL: 30"

BORING CO: PSI - Omaha

FOREMAN: Gary Loughlin

OBG GEOLOGIST: Dave Calka

RIG: CME-55

BORING LOCATION: Southeast of lagoon

GROUND ELEVATION: 994.9 TOC: 997.67

DATES: STARTED: 6-16-80 ENDED: 6-16-80

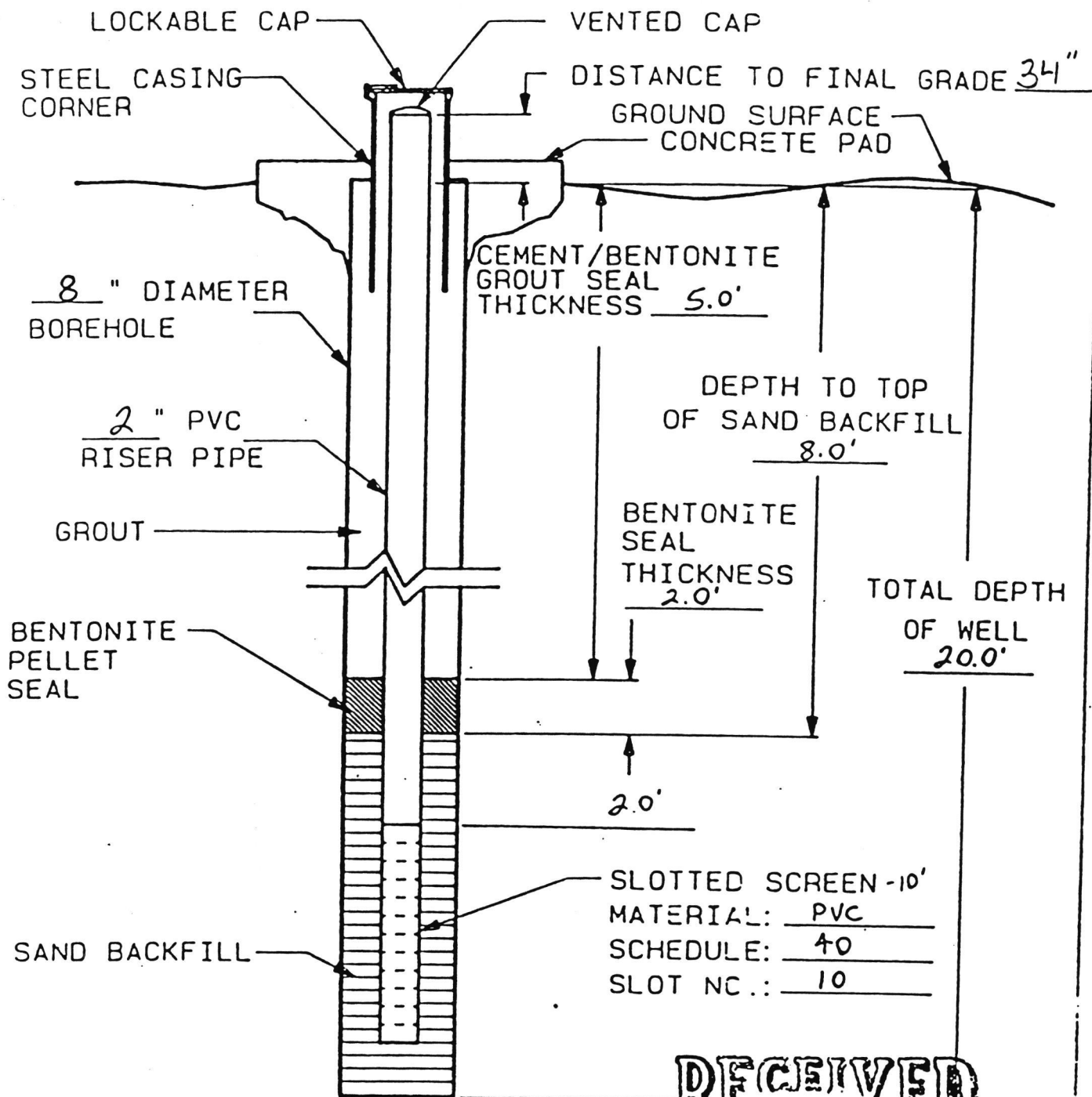
DEPTH (Feet)	SAMPLE					SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	FIELD TESTING		
	NO.	(Feet) DEPTH	BLOWS 6"	PEN/ REC.	"N" VALUE			SAL 0/100	SP. COND.	HNL
15						Medium brown and gray to slight	CL			
16						green-gray silty clay, some				
17						rust colored staining, trace				
18						to some fine sand - moist to				
19	5	18.5-20.0	4			wet				
			5			Same				
20			7			Silt and fine sand content				
						increasing				
21						T.D. - 20.0'				
22						- Boring was completed as a 2-inch				
						PVC ground water monitoring well.				
						10.0 feet of #10 machine slot				
						well screen was set at approx.				
						20 feet below ground surface (BS)				
						- Riser casing from 10.0 feet (BS)				
						to 34-inches above grade (final				
						stick up)				
						- Sand pack from 20.0 feet to 8.0				
						feet.				
						- Bentonite pellet seal from 8.0				
						feet to 6.0 feet				
						- Cement/Bentonite grout from				
						6.0 feet to within 1.0 feet				
						of surface				
						- Well covered with rock to				
						steel casing set in concrete				
						pad approximately 5-inches				
						deep and 30-inches in diameter				

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AUG 14 1989

WASTE MANAGEMENT  
PROGRAM

- Well development - approximately  
23 gallons of water removed.  
Discharged to ground approx 100 ft.  
east.

WELL NO. 35



**RECEIVED**

FINAL WATER LEVEL: 9.31

AUG 14 1989  
FEET BELOW TOP OF CASING.

INSPECTED BY: Dave Cika

WASTE MANAGEMENT  
DATE: 8/16/89

# OVERBURDEN MONITOR WELL FIELD LOG



O'BRIEN &amp; GERE

## TEST BORING LOG

BORING NO. 3D SHT. 1 OF 1

GROUND WATER

DEPTH DATE ELEV.  
DEPTH DATE ELEV.

## PROJECT LOCATION:

Maryville, Missouri

CLIENT: North Lloyd Char. Co

## SAMPLER

TYPE: ASTM D 1586-84

HAMMER: 140 lbs

FALL: 30"

FILE NO: 3050.005

BORING CO: PSI - Omaha

FOREMAN: Gary Lashlin

OBG GEOLOGIST: Dave Ciska

RIG: CRE-55

BORING LOCATION: Southeast of Lagoon

GROUND ELEVATION: 994.9 TOC: 997.71

DATES: STARTED: 6-16-89

ENDED: 6-16-89

DEPTH	SAMPLE				Augering with H.S.A. 3 1/4" I.D. - 7 1/2" O.D.	SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	FIELD TESTING		
	NO.	(Feet) DEPTH	BLOWS 6"	PEN/ REC.	N° VALUE			SAL g/cc	SP. COND	HNL
1	1	0.0-1.5	4			3" topsoil over fill - medium to dark gray and brown clayey silt, trace to some fine sand; trace crushed rock - damp to moist	Fill			
2			4							
3			6							
4	2	3.5-5.0	3			Apparent end of fill at 4.0'				
5			5				CL			
6			6			Medium gray to green gray silty clay, some rust colored staining, trace fine sand - moist				
7										
8										
9	3	8.5-10.0	2			Medium to dark gray silty clay, some rust colored staining, trace fine sand - moist to wet				
10			2							
11			2			Becoming wet				
12										
13										
14	4	13.5-15.0	3			Medium brown and gray silty clay with some rust colored staining, trace to some fine sand - moist to wet				
			3							
			4							

RECEIVED  
AUG 14 1989WASTE MANAGEMENT  
PROGRAM



O'BRIEN &amp; GERE

## TEST BORING LOG

BORING NO. 3D SHT. 2 OF 3

## PROJECT LOCATION:

Maryville, Missouri

CLIENT: Nixdorf H. Lloyd Chapman Co.

## SAMPLER

TYPE: ASTM D 1586-84

HAMMER: 140 lbs.

FALL: 30"

## GROUND WATER

DEPTH

DATE

ELEV.

DEPTH

DATE

ELEV.

FILE NO: 3050.005

DRILLING CO: PSI - Omaha

RIG: CRE-55

FOREMAN: Gary Laughlin

BQ GEOLOGIST: Dave C. Ka

BORING LOCATION: Southeast of lagoon

GROUND ELEVATION: 994.9 TOC: 997.71

DATES: STARTED: 6-16-89

ENDED: 6-16-89

## SAMPLE

Augering  
with

## SAMPLE

## DESCRIPTION

STRATUM  
CHANGE  
DEPTH

## FIELD TESTING

SAL  
p/100SP.  
COND.

HNU

RMK B

NO. (Feet) DEPTH BLOWS PEN/ REC. "N" VALUE

H.S.A. 3 3/4" I.D. - 7 1/8" O.D.

Medium brown and gray to slight  
green-gray silty clay, some  
rust colored staining, trace to  
some fine sand - moist to wet

Same

Fine sand content increasing

5 20.0-21.5 2

Medium gray fine sand, some black  
specks, trace of silt - sand not  
silt, subangular to subrounded, medi-  
umly sorted - wet

SP

3

4

6 23.5-25.0 4

Light to medium gray fine to  
medium sand, some black specks,  
occasional coarse sand, sub-  
angular to subrounded, poorly sorted -  
wet

6

7

7 25.0-26.5 5

Medium gray fine to coarse sand,  
poorly sorted - wet

8

9

8 26.5-28.0 5

Clay and silt content increasing

9

10

9 28.5-30.0 3

Dark gray clay, occ. black mottling,  
some fine to medium sand, trace  
fine to coarse sand - moist

CL

5

7

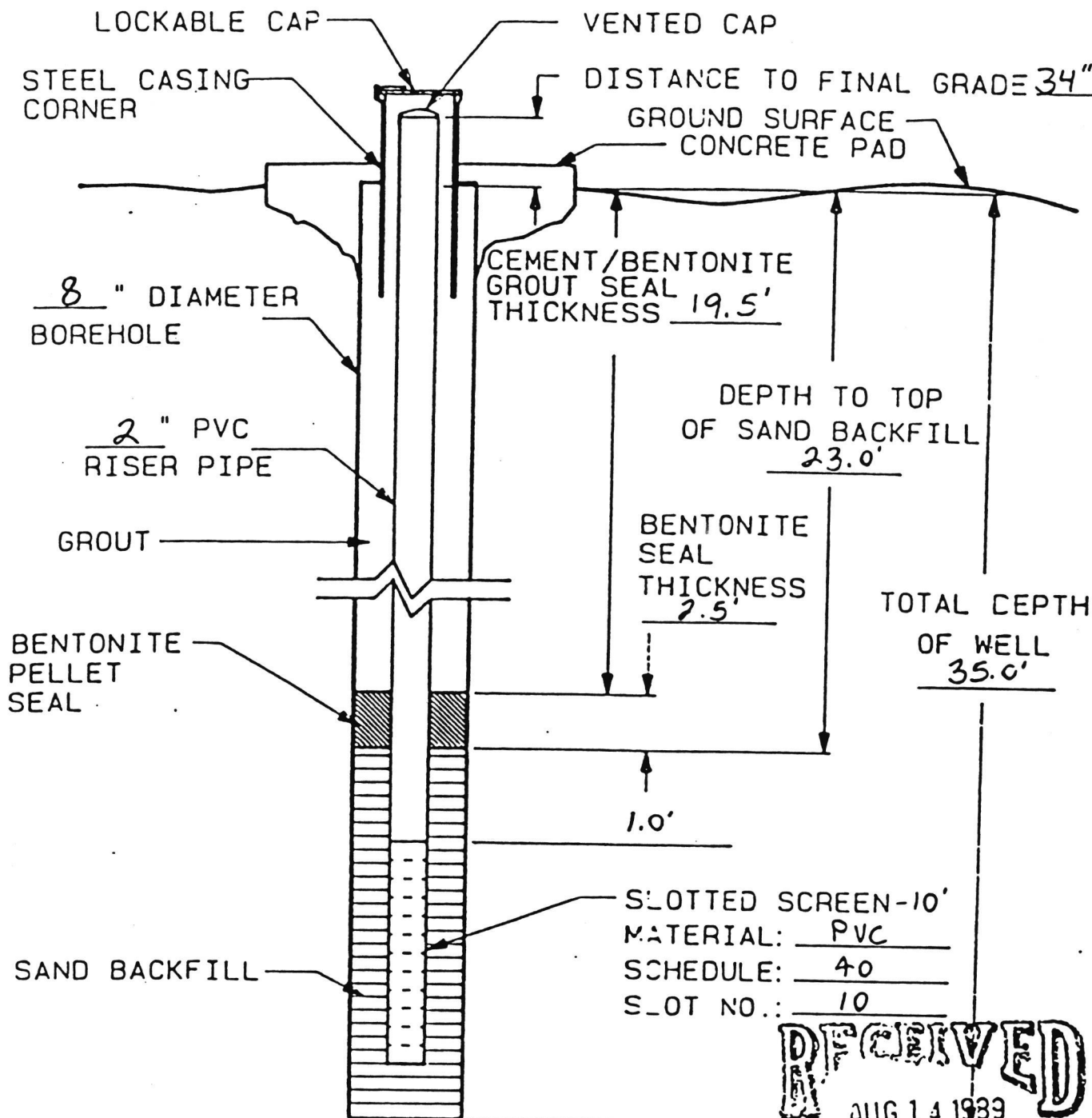
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AUG 14 1989

WAS F. M. H. ...  
TH. J. H. M.

[illegible]

WELL NO. 30



**RECEIVED**  
AUG 14 1989

FINAL WATER LEVEL: 9.17 FEET BELOW TOP OF CASING.

INSPECTED BY: Dave Cika DATE: 6-16-89

# OVERBURDEN MONITOR WELL FIELD LOG

O'BRIEN & GERE ENGINEERS, INC.		TEST BORING LOG	Report of Boring No. MW 4s, 4d Sheet 1 of 1
Project Location Warrenton, Missouri		Type: Sampler	Ground Water Depth      Date
Contract: Lloyds Chain Company		Hammer: Fall:	Depth - Date -
Boring Co. Omaha Testing Division - P.S.I.		File No. 305A.005	
Foreman: Scott Kratz		Boring Location: MW 4s, 4d	
786 Geologist: Peter Fogardus		Ground Elevation:	
		Dates: Started: 11/6/65	

Ended: 11/6

Depth	Sample		Sample Description	Stratum Change General Descript	Equipment Installed	Notes
	Penetrn/ Recovery	Depth				
0'	1	0-1.5	6-6-6 Orange-brown, moist, SILT, some fine Sand, trace Clay			
6'	2	5-6.5	3-5-6 Gray-green, moist, SILT, some Clay, trace fine Sand. (iron oxide stains)			
12'	3	10-11.5	1-1-2 Gray-green, moist, SILT and CLAY, trace fine Sand. (iron oxide stains)			
12'	4	15-16.5	2-3-4 Gray-green, moist, SILT, some Clay, trace fine Sand			
24'	5	20-21.5	1-1-1 Gray, wet, FINE to MEDIUM SAND			
30'	6	25-26.5	8-8-11 Gray, wet FINE to COARSE SAND, little fine Gravel.			
36'	7	30-31.5	7-6-5			
36'		35-36.5	Shelby Gray-black, moist, CLAY, little Silt, trace coarse Sand			

O'BRIEN & GERE  
ENGINEERS, INC.

# TEST BORING LOG

Report of Boring No. YH 55, S  
Sheet 1 of 1

Project Location:  
Maryville, Missouri  
Client:  
Hixocoff-Lloyd Chain Company

Type:  
Hammer:  
Fall:

SAMPLER

Ground Water Depth      Date  
Depth - Date -

File No. 3050.005

Boring Co. Omaha Testing Division - P.S.I.  
Foreman: Scott Kratz  
O&G Geologist: Peter Rogardus

Boring Location: YH 55, Sd  
Ground Elevation:  
Dates: Started: 11/5/85

Ended:

Depth	Sample		Flows /6"	Sample Description	Stratum Change General Descript	Equipment Installed	Foundation Notes
	Peretrm/ Recovery	Depth					
0'	1	0-1.5	3-3-4	Gray, moist, SILT, some organics			
6'	2	5-6.5	3-4-7	Gray-green, moist, SILT, some Clay, trace fine Sand			
12'	3	10-11.5	2-3-5				
18'	4	15-16.5	2-2-3	Black, wet, SILT, some fine Sand			
24'	5	20-21.5	2-3-4	Gray, moist, SILT, some Clay, trace fine Sand. (varved silt and clay lenses)			
30'	6	25-26.5	5-4-6	Gray, wet, FINE to MEDIUM SAND			
36'	7	30-31.5	7-12-17	Gray, wet, FINE to COARSE SAND (1/2 inch silt lense at 31.5 feet)			
42'	8	35-36.5	7-10-11	Gray-black, moist, CLAY, some Silt, trace Coarse Sand.			

O'BRIEN & GERE  
ENGINEERS, INC.

TEST BORING LOG

65/6P

Report of Boring No. M  
Sheet 1 of 1

Project Location  
Maryville, Missouri  
Client:  
Mixdorff-Lloyd Chain Company

Type:  
Hammer:  
Fall:

SAMPLER

Ground Water Depth  
Depth - D<sub>g</sub>

Boring Co. Omaha Testing Division - P.S.I.  
Foreman: Scott Kratz  
OBG Geologist: Peter Rogardus

Boring Location: MW 6s, 6d  
Ground Elevation:  
Dates: Started: 11/3/85

File No. 3050.005

Depth	Sample		Sample Description	Stratum Change General Descript	Equipment Installed
	Penetrn/ Recovery	Depth			
0'	1	0-1.5	6-6-7 Gray, moist, SILT, some fine Sand, trace Clay, organics		
5'	2	5-6.5	3-3-5 Gray-green, moist, SILT, some Clay, trace fine Sand, (iron oxide stains)		
10'	3	10-11.5	1-2-2 Gray-green, wet, FINE SAND, little Clay		
15'	4	15-16.5	2-3-3 Gray, wet, SILT, some Fine to Medium SAND		
20'	5	20-21.5	7-12-15 Gray, wet, FINE to COARSE SAND		
25'	6	25-26.5	6-7-11		
30'	7	30-31.5	4-8-9 Gray-black, moist CLAY, some Silt, trace coarse Sand		

O'BRIEN & GERE  
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No. MW 7  
Sheet 1 of 1

Project Location  
Maryville, Missouri  
Client:  
Nixdorff-Lloyd Chain Company

Type:  
Hammer:  
Fall:

SAMPLER

Ground Water Depth      Date  
Depth - Date -

File No. 3050.005

Boring Co. Omaha Testing Division - P.S.I.  
Foreman: Scott Kratz  
O&G Geologist: Peter Bogardus

Boring Location: MW 7  
Ground Elevations:  
Dates: Started: 11/6/65

Ended: 1.

Depth	Sample		Depth	Flows /6"	Sample Description	Stratum Change General Descript	Equipment Installed	Field Testir		
	Penetratd/ Recovery							pH	So Cond	W
0'	1		0-1.5	4-4-5	Gray, moist, SILT, some fine Sand, trace Clay, organics					
					2'					
6'	2		5-6.5	2-3-5	Orange, moist, SILT, some Clay, trace fine Sand, (iron oxide stains)					
					5.5'					
12'	3		10-11.5	2-2-3	Gray-green, moist, SILT, some Clay, trace fine to coarse Sand, (iron oxide stains)					
					11'					
					Red-brown, moist, SILT, some Clay, trace fine to coarse Sand, (iron oxide stains)					
					13'					
16'	4		15-16.5	6-10-10	Gray, wet, FINE SAND, (silt lenses)					
					16'					
24'	5		20-21.5	6-10-10	Gray, wet, FINE to MEDIUM SAND					
					23'					
30'	6		25-26.5	5-11-5	Gray, wet, FINE to COARSE SAND, some fine to coarse Gravel, trace Clay					
					25'					
36'	7		30-31.5	SHELBY	Gray-black, moist, CLAY, little silt, trace coarse Sand					
42'	8		40-41.5	SHELBY NO. REC						
48'	9		45-46.5	SHELBY						
54'	10		46.5-47	SHELBY						

O'BRIEN & GERE  
ENGINEERS, INC.

TEST BORING LOG

MW-8

Report of Boring No. MW  
Sheet 1 of 1

Project Location  
Maryville, Missouri  
Client:  
Nixdorff-Lloyd Chain Company

Type:  
Hammer:  
Fall:

SAMPLER

Ground Water Depth Date  
Depth - Date -

Boring Co. Omaha Testing Division - P.S. 1.  
Foreman: Scott Kratz  
O&G Geologist: Peter Repardus

Boring Location: MW 8  
Ground Elevation:  
Dates: Started: 11/7/65

File No. 3050.005

Ends

Depth	Penetration/Recovery	Sample		Sample Description	Stratum Change General Descript	Equipment Installed	Field Test	
		Depth	Blows /ft				pH	Soil Cond
0'	1	0-1.5	3-5-5	Gray, moist SILT, some fine Sand, trace Clay, organics.				
3'								
5'	2	5-5.5	3-4-3	Gray-green, moist, SILT, some Clay, trace fine Sand. (iron oxide stains)				
10'	3	10-11.5	2-2-2	Gray, wet, SILT, some CLAY				
15'	4	15-16.5	3-4-5	Gray-green, moist, SILT, some Clay, trace fine Sand. (iron oxide stains)				
20'	5	20-21.5	4-3-6	Gray, wet, FINE SAND, some Clay, trace Silt				
25'	6	25-26.5	11-11-15	Gray, wet, FINE to COARSE SAND, little fine Gravel.				
30'	7	30-31.5	5-5-5	Gray-black, moist Clay, some Silt, trace coarse Sand.				
35'	8	35-36.5	SHELAY					
				FOB 36.5				

<b>O'BRIEN &amp; GERE</b>	<b>TEST BORING LOG</b>	BORING NO. <b>GMW #9</b> SHT. 1 OF 1 GROUND WATER enters at 17' 0" DEPTH DATE ELEV. DEPTH DATE ELEV. FILE NO: <b>3050.005</b>
PROJECT LOCATION: <b>Maryville, Missouri</b> CLIENT: <b>Nixdorff Krein</b>	SAMPLER TYPE: <b>ASTM D 1586-84</b> HAMMER: <b>140 lbs</b> FALL: <b>30"</b>	

BORING CO: <b>PSI</b> FOREMAN: <b>Scott Kratz</b> OBG GEOLOGIST: <b>Dave Cika</b>	<b>R16: CME-55</b>	BORING LOCATION: <b>South of GMW #4</b> GROUND ELEVATION: <b>994.5</b> DATES: STARTED: <b>4-27-90</b> TOC: <b>997.34</b> ENDED: <b>4-27-</b>
---	--------------------	---

DEPTH	SAMPLE					SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	FIELD TESTS	
	NO.	(Feet) DEPTH	BLOWS 8"	PEN/ REC.	*N VALUE			SAL g/cc	SP. COND.
0						HSA-3 3/4" I.D. - 7" O.D.			
						Fill - 5" concrete over approx. 7" of crushed rock base	Fill		
1						Medium brown and gray to dark gray silty clay, some rust colored staining, trace fine sand - moist	CL		
2									
3									
4									
	#1	4.0-6.0	2	2 1/2		Medium brown and gray silty clay with some black mottling, trace roots and fine sand - moist			
			3						
5			5						
			5						
6									
7									
8									
	#2	9.0-11.0	3			Medium gray silty clay, occ some brown and rust colored streaking and mottling, occ some zones with some fine sand - moist			
			3						
10			3						
			5						
11									
12						Sand content increasing			
13									
	#3	14.0-16.0	5			Medium gray and rust colored orange-brown silty clay, some fine sand - moist			
15			6						

\* Ground Water enters at 17' W.D.



O'BRIEN &amp; GERE

## TEST BORING LOG

BORING NO. GMW#9 SHT. 2 OF 2

## PROJECT LOCATION:

Maryville, Missouri

CLIENT: Nixdorff Krein

## SAMPLER

TYPE: ASTM D 1586-84

HAMMER: 140 lbs.

FALL: 30"

## GROUND WATER

DEPTH

DATE

ELEV.

DEPTH

DATE

ELEV.

FILE NO: 3050.005.

BORING CO: P&amp;I

FOREMAN: Scott Kratz

OBG GEOLOGIST: Dave Cika

RIG: CME-55

BORING LOCATION: South of GMW#4

GROUND ELEVATION:

DATE: 8/27-90

TOC:

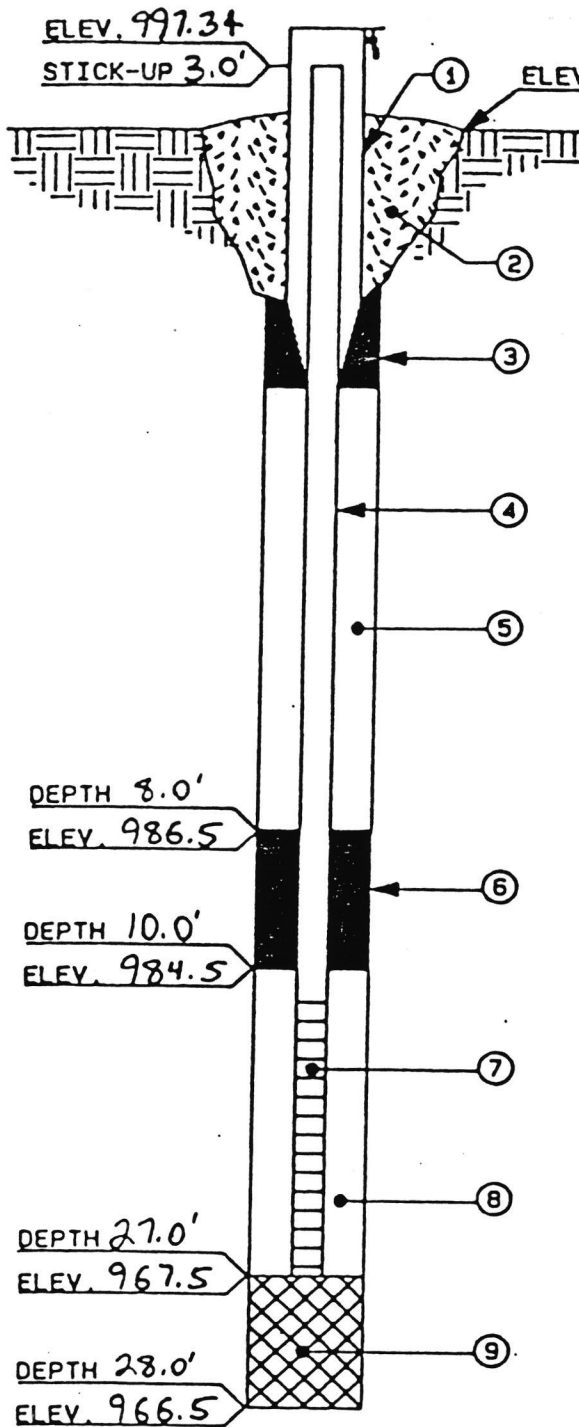
ENDED: 4-27-90

DEPTH	SAMPLE					SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	FIELD TESTING		
	NO.	(feet) DEPTH	BLOWS 6"	PEN/ REC.	"N" VALUE			SAL p/oc	SP. COND.	HL
15			6			HSA - 3 3/4" I.D. - 7" O.D.				
			6			Grading into a sandy clay at 15.5'				
16			6			Medium gray fine sandy clay - moist	SC			
17						Water enters borehole at 17.0'	SP			
18						Light to medium gray and tan fine sand, slightly silty, poorly sorted, subangular to subrounded, trace fine black specks - wet				
19	#4	19.0-21.0	5							
20			6							
			5							
21			10			Same with trace to some gravel				
22	#5	22.0-24.0	5							
23			7			Gravel content increasing				
			8							
24			10			Light to medium gray fine to coarse sand with fine gravel, trace medium to coarse gravel, subangular to subrounded, fairly well sorted - wet	SP-GP			
25	#6	24.0-26.0	7							
			7							
			3							
26			5			Dark gray silty clay - moist	CL			
	#7	26.0-28.0	5							
27			8			Light to medium gray fine to coarse sand with fine gravel, trace to some medium to coarse gravel - wet	SP-GP			
			9							
28			11							
29						T.D. - 28.0' below grade in fine to coarse sand and gravel				
30						Borehole completed as monitoring well GMW#9				

Boring was completed as a 2" PVC ground water monitoring well, 15.0' of #10 well screen was set at 27.0' below grade, sandpack from 27.0' to 10.0', bentonite pellet seal from 10.0' to 8.0', and grout from 8.0' to within 1.5' of grade. A locking steel protective casing was set in concrete over the riser casing.

GMW #9

ACHTER>MISC.DETAILS>S.MONT.WELL



ALL DEPTHS MEASURED  
FROM GROUND SURFACE

## GROUND WATER MONITORING WELL

Nixdorff-Krein

### MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 3050.005

BORING/WELL NO. GMW #9

DATE 4-27-90

GEOLOGIST/RIG Dave Cika / CME-55

1. PROTECTIVE CASING ☒ YES NO 2 protective  
LOCKING ☒ YES NO posts
2. CONCRETE SEAL ☒ YES NO
3. TYPE OF SURFACE SEAL (IF INSTALLED)  
Concrete & 3 protective posts.
4. SOLID PIPE TYPE Schedule 40 PVC  
SOLID PIPE LENGTH 15.0 FT.  
JOINT TYPE SLIP ☒ THREADED WELDED
5. TYPE OF BACKFILL Cement / bentonite  
HOW INSTALLED- surface pour
6. TYPE OF LOWER SEAL (IF INSTALLED)  
3/8" bentonite pellets (1-5 gal. Pail)
7. SCREEN TYPE Schedule 40 PVC  
SCREEN LENGTH 15.0 FT.  
SLOT-SIZE #10 machine slot  
SCREEN DIAMETER 2 IN. I.D.
8. TYPE OF BACKFILL AROUND SCREEN  
Ohawa Sand pack thru augers
9. TYPE OF BACKFILL Native sand collapse
10. DRILLING METHOD HSA
11. ADDITIVES USED (IF ANY)  
N/A

WATER LEVEL 8.79 DATE 4-27-90

Development accomplished by  
pumping of approximately 100 gallons  
of water

MONT.WELL

**G** O'BRIEN & BEEBE  
ENGINEERS, INC.

\*Boring was completed as a 2" PVC piezometer. 10.0' of #10 well screen was set at 15.0' below ground surface, sand packed to 4.0', sealed with 2' of bentonite, and grouted from 2.0' to ground surface. The 2" I.D. riser casing was allowed to extend approximately 5.0' above the ground surface. Riser casing was covered with a PVC cap.

O'BRIEN & GERE

# TEST BORING LOG

BORING NO. P-2 SHT. 1 C

GROUND WATER

DEPTH	DATE	ELEV.
DEPTH	DATE	ELEV.

FILE NO: 3050.005

PROJECT LOCATION: Maryville,  
Missouri

CLIENT: Nixdorff Lloyd Chain Co.

SAMPLER  
TYPE: ASTM-1586-84  
HAMMER: 140 lbs.  
FALL: 30"

BORING CO: Midwest Drilling, Inc. RIG: CME-550-  
FOREMAN: Brian Wilson  
OBG GEOLOGIST: Dave Cika  
ATV

BORING LOCATION: North of former lagoon  
GROUND ELEVATION: 997.0 TOC: 1001.97(MSL)  
DATES: STARTED: 6/14/88 ENDED: 6/14

[illegible]

Boring was completed as a 2" PVC piezometer. 10.0' of #10 well screen was set at 15.0' below ground surface, sand packed to 4.0', sealed with 2' of bentonite, and grouted from 2.0' to ground surface. The 2" I.D. riser casing was allowed to extend approximately 5.0' above the ground surface. Riser casing was covered with a PVC cap.




**O'BRIEN & GERE**

# TEST BORING LOG

BORING NO. P-4 SHT. 1

PROJECT LOCATION: Maryville,  
Missouri

CLIENT: Nixdorff Lloyd Chain Co

SAMPLER  
TYPE: ASTM-1586-84  
HAMMER: 140 lbs.  
FALL: 30"

GROUND WATER

DEPTH	DATE	ELEV
DEPTH	DATE	ELEV

FILE NO: 3050.005

BORING CO: Midwest Drilling, Inc. RIG: CME-550-  
FOREMAN: [illegible]

FOREMAN: Brian Wilson  
OBG GEOLOGIST: Dave Cika

**ATV**

BORING LOCATION: West of former lagoon  
GROUND ELEVATION: 003.1 T20

GROUND ELEVATION: 997.4 TOC: 1002.53 (MSL)  
DATES: STARTED: 6/14/88 ENDED: 6/14

ENDED: 6/14

[illegible]

oring was completed as a 2" PVC piezometer. 10.0' of #10 well screen was set at 15.0' low ground surface, sand packed to 4.0', sealed with 2' of bentonite, and grouted from 2.0' to ground surface. The 2" I.D. riser casing was allowed to extend approximately 5.0' above the ground surface. Riser casing was covered with a PVC cap.

## **Appendix C**

### **Health and safety plan**

## APPENDIX C

### HEALTH AND SAFETY PLAN

Review of existing soil and ground water laboratory analytical data indicates that Level D clothing protection is appropriate for conducting the field sampling program at the site. Protection requirements included in Level D are: steel-toed work boots, work clothing, rubber gloves, protective eyewear, hard hats and noise protection where appropriate. In addition, personnel performing sampling at the site will have appropriate Hazardous Waste Site Operations 40-hour training per Occupational Safety and Health Administration regulations (OSHA 1910.120), as well as be involved in an O'Brien & Gere Engineers, Inc. surveillance program of annual OSHA physicals.

Should any medical or chemical emergency occur during sampling activities, O'Brien & Gere Engineers, Inc. personnel would contact the on-site emergency coordinator. The emergency coordinator is:

Al Macali, Jr.  
Manager of Environmental & Products Standard  
Laclede Chain Manufacturing Co.  
2500 East First Street  
P. O. Box 249  
Maryville, MO 64468  
(816) 562-2160

The name, address and telephone number of the nearest medical care facility is:

St. Francis Hospital  
2016 South Main  
Maryville, MO 64468  
(816) 562-2600

From the Nixdorff-Lloyd facility, go west on First Street to Highway 71. Go south on Highway 71 approximately 1.5 miles. St. Francis Hospital is on the west side of Highway 71. A map illustrating directions from the facility to St. Francis Hospital has been included.



## **Appendix D**

### **Chain of custody**

**O'BRIEN & GERE  
ENGINEERS, INC.**

Office: St. Louis, MO

Address: 5000 Cedar Plaza Parkway

Phone: (314) 842-4550

Job No. 3050.005

Sheet 1 of     

**CHAIN OF CUSTODY**

Client: INLAND REALTY CO Location: MARYVILLE, MISSOURI			Collected By: (Signature)			
SAMPLE DESCRIPTION	Date	Time	Sample Matrix <sup>1</sup>	Sample Type <sup>2</sup>	No. of Containers <sup>3</sup>	ANALYSIS REQUESTED
GMW #2S			Water	Grab	1-P, 500 mL	Cyanide (CN)
GMW #2S			Water	Grab	1-P, 500 mL	Total lead (Pb) and zinc (Zn)
GMW #2S			Water	Grab	1-P, 500 mL	Hexavalent chromium (Cr <sup>VI</sup> )
GMW #2S			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, mercury (Hg), manganese (Mn), Nickel (Ni)
GMW #2D			Water	Grab	1-P, 500 mL	CN
GMW #2D			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #2D			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #2D			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
GMW #3			Water	Grab	1-P, 500 mL	CN
GMW #3			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #3			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #3			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
Maximum Method Detection Limits: CN, Cd, Cr, Mn, Ni - 5 ppb; Pb - 2 ppb; Hg - 0.2 ppb; Zn - 10 ppb						

<sup>1</sup>Matrix = water, wastewater, air, sludge, sediment, etc.

<sup>2</sup>Type = grab, composite

<sup>3</sup>Containers = P - polyethylene; G - glass

Chemical Preservatives:

Metals - HNO<sub>3</sub> to pH 2

Cyanide - NaOH to pH 12

Relinquished by: _____ of: _____	Date _____	Time _____	Received by:- _____ of: _____	Date _____	Time _____
Relinquished by: _____ of: _____	Date _____	Time _____	Received by: _____ of: _____	Date _____	Time _____
Relinquished by: _____ of: _____	Date _____	Time _____	Received by: _____ of: _____	Date _____	Time _____
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: _____ of: _____	Date _____	Time _____	Courier Name: _____  *Attach delivery/courier receipt to Chain of Custody	Date _____	Time _____
Relinquished by: _____ of: _____	Date _____	Time _____	Received by: _____ of: _____	Date _____	Time _____

**O'BRIEN & GERE  
ENGINEERS, INC.**

Office: St. Louis, MO

Address: 5000 Cedar Plaza Parkway

Phone: (314) 842-4550

Job No. 3050.005

Sheet 2 of     

**CHAIN OF CUSTODY**

<b>Client: INLAND REALTY CO</b>			<b>Collected By:</b>			
<b>Location: MARYVILLE, MISSOURI</b>			<b>(Signature)</b>			
SAMPLE DESCRIPTION	Date	Time	Sample Matrix <sup>1</sup>	Sample Type <sup>2</sup>	No. of Containers <sup>3</sup>	ANALYSIS REQUESTED
GMW #3S			Water	Grab	1-P, 500 mL	Cyanide (CN)
GMW #3S			Water	Grab	1-P, 500 mL	Total lead (Pb) and zinc (Zn)
GMW #3S			Water	Grab	1-P, 500 mL	Hexavalent chromium (Cr <sup>VI</sup> )
GMW #3S			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, mercury (Hg), manganese (Mn), Nickel (Ni)
GMW #3D			Water	Grab	1-P, 500 mL	CN
GMW #3D			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #3D			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #3D			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
GMW #4S			Water	Grab	1-P, 500 mL	CN
GMW #4S			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #4S			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #4S			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
Maximum Method Detection Limits: CN, Cd, Cr, Mn, Ni - 5 ppb; Pb - 2 ppb; Hg - 0.2 ppb; Zn - 10 ppb						

<sup>1</sup>Matrix = water, wastewater, air, sludge, sediment, etc.

<sup>2</sup>Type = grab, composite

<sup>3</sup>Containers = P - polyethylene; G - glass

Chemical Preservatives:

Metals - HNO<sub>3</sub> to pH 2

Cyanide - NaOH to pH 12

Relinquished by: _____ of: _____	Date	Time	Received by:- _____ of: _____	Date	Time
Relinquished by: _____ of: _____	Date	Time	Received by: _____ of: _____	Date	Time
Relinquished by: _____ of: _____	Date	Time	Received by: _____ of: _____	Date	Time
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: _____ of: _____	Date	Time	Courier Name: _____  *Attach delivery/courier receipt to Chain of Custody	Date	Time
Relinquished by: _____ of: _____	Date	Time	Received by: _____ of: _____	Date	Time

**O'BRIEN & GERE  
ENGINEERS, INC.**

Office: St. Louis, MO

Address: 5000 Cedar Plaza Parkway

Phone: (314) 842-4550

Job No. 3050.005

Sheet 3 of    

**CHAIN OF CUSTODY**

<b>Client: INLAND REALTY CO</b>			<b>Collected By:</b>			
<b>Location: MARYVILLE, MISSOURI</b>			<b>(Signature)</b>			
SAMPLE DESCRIPTION	Date	Time	Sample Matrix <sup>1</sup>	Sample Type <sup>2</sup>	No. of Containers <sup>3</sup>	ANALYSIS REQUESTED
GMW #4D			Water	Grab	1-P, 500 mL	Cyanide (CN)
GMW #4D			Water	Grab	1-P, 500 mL	Total lead (Pb) and zinc (Zn)
GMW #4D			Water	Grab	1-P, 500 mL	Hexavalent chromium (Cr <sup>VI</sup> )
GMW #4D			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, mercury (Hg), manganese (Mn), Nickel (Ni)
GMW #3DA			Water	Grab	1-P, 500 mL	CN
GMW #3DA			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #3DA			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #3DA			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
GMW #10			Water	Grab	1-P, 500 mL	CN
GMW #10			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #10			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #10			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
Maximum Method Detection Limits: CN, Cd, Cr, Mn, Ni - 5 ppb; Pb - 2 ppb; Hg - 0.2 ppb; Zn - 10 ppb						

<sup>1</sup>Matrix = water, wastewater, air, sludge, sediment, etc.

<sup>2</sup>Type = grab, composite

<sup>3</sup>Containers = P - polyethylene; G - glass

Chemical Preservatives:

Metals - HNO<sub>3</sub> to pH 2

Cyanide - NaOH to pH 12

Relinquished by: _____	Date	Time	Received by:- _____	Date	Time
	of: _____		of: _____		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
	of: _____		of: _____		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
	of: _____		of: _____		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: _____	Date	Time	Courier Name: _____  *Attach delivery/courier receipt to Chain of Custody	Date	Time
	of: _____				
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
	of: _____		of: _____		

**O'BRIEN & GERE  
ENGINEERS, INC.**

Office: St. Louis, MO

Address: 5000 Cedar Plaza Parkway

Phone: (314) 842-4550

Job No. 3050.005

Sheet 4 of     

**CHAIN OF CUSTODY**

<b>Client: INLAND REALTY CO</b>			<b>Collected By:</b>			
<b>Location: MARYVILLE, MISSOURI</b>			<b>(Signature)</b>			
SAMPLE DESCRIPTION	Date	Time	Sample Matrix <sup>1</sup>	Sample Type <sup>2</sup>	No. of Containers <sup>3</sup>	ANALYSIS REQUESTED
GMW #5S			Water	Grab	1-P, 500 mL	Cyanide (CN)
GMW #5S			Water	Grab	1-P, 500 mL	Total lead (Pb) and zinc (Zn)
GMW #5S			Water	Grab	1-P, 500 mL	Hexavalent chromium (Cr <sup>VI</sup> )
GMW #5S			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, mercury (Hg), manganese (Mn), Nickel (Ni)
GMW #5D			Water	Grab	1-P, 500 mL	CN
GMW #5D			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #5D			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #5D			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni

Maximum Method Detection Limits: CN, Cd, Cr, Mn, Ni - 5 ppb; Pb - 2 ppb; Hg - 0.2 ppb; Zn - 10 ppb

<sup>1</sup>Matrix = water, wastewater, air, sludge, sediment, etc.

<sup>2</sup>Type = grab, composite

<sup>3</sup>Containers = P - polyethylene; G - glass

Chemical Preservatives:

Metals - HNO<sub>3</sub> to pH 2

Cyanide - NaOH to pH 12

Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: _____	Date	Time	Courier Name: _____	Date	Time
of: _____			_____		
			<b>*Attach delivery/courier receipt to Chain of Custody</b>		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		

**O'BRIEN & GERE  
ENGINEERS, INC.**

Office: St. Louis, MO

Address: 5000 Cedar Plaza Parkway

Phone: (314) 842-4550

Job No. 3050.005

Sheet 5 of     

**CHAIN OF CUSTODY**

Client: INLAND REALTY CO Location: MARYVILLE, MISSOURI			Collected By: (Signature)			
SAMPLE DESCRIPTION	Date	Time	Sample Matrix <sup>1</sup>	Sample Type <sup>2</sup>	No. of Containers <sup>3</sup>	ANALYSIS REQUESTED
GMW #6S			Water	Grab	1-P, 500 mL	Cyanide (CN)
GMW #6S			Water	Grab	1-P, 500 mL	Total lead (Pb) and zinc (Zn)
GMW #6S			Water	Grab	1-P, 500 mL	Hexavalent chromium (Cr <sup>VI</sup> )
GMW #6S			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, mercury (Hg), manganese (Mn), Nickel (Ni)
GMW #6D			Water	Grab	1-P, 500 mL	CN
GMW #6D			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #6D			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #6D			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
GMW #7			Water	Grab	1-P, 500 mL	CN
GMW #7			Water	Grab	1-P, 500 mL	Total Pb and Zn
GMW #7			Water	Grab	1-P, 500 mL	Cr <sup>VI</sup>
GMW #7			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, Hg, Mn, Ni
Maximum Method Detection Limits: CN, Cd, Cr, Mn, Ni - 5 ppb; Pb - 2 ppb; Hg - 0.2 ppb; Zn - 10 ppb						

<sup>1</sup>Matrix = water, wastewater, air, sludge, sediment, etc.

<sup>2</sup>Type = grab, composite

<sup>3</sup>Containers = P - polyethylene; G - glass

Chemical Preservatives:

Metals - HNO<sub>3</sub> to pH 2

Cyanide - NaOH to pH 12

Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: _____	Date	Time	Courier Name: _____	Date	Time
of: _____			_____		
			*Attach delivery/courier receipt to Chain of Custody		
Relinquished by: _____	Date	Time	Received by: _____	Date	Time
of: _____			of: _____		

**Phone:** (314) 842-4550

Sheet 6 of       

## CHAIN OF CUSTODY

<b>Client:</b> INLAND REALTY CO <b>Location:</b> MARYVILLE, MISSOURI			<b>Collected By:</b> (Signature)			
SAMPLE DESCRIPTION	Date	Time	Sample Matrix <sup>1</sup>	Sample Type <sup>2</sup>	No. of Containers <sup>3</sup>	ANALYSIS REQUESTED
GMW #9			Water	Grab	1-P, 500 mL	Cyanide (CN)
GMW #9			Water	Grab	1-P, 500 mL	Total lead (Pb) and zinc (Zn)
GMW #9			Water	Grab	1-P, 500 mL	Hexavalent chromium (Cr <sup>VI</sup> )
GMW #9			Water	Grab	1-P, 1 L	Total Metals-Cd, Cr, mercury (Hg), manganese (Mn), Nickel (Ni)

Maximum Method Detection Limits: CN, Cd, Cr, Mn, Ni - 5 ppb; Pb - 2 ppb; Hg - 0.2 ppb; Zn - 10 ppb

<sup>3</sup>Containers = P - polyethylene; G - glass

**Cyanide - NaOH to pH 12**

Relinquished by: _____ of: _____	Date _____ _____	Time _____ _____	Received by:- _____ of: _____	Date _____ _____	Time _____ _____
Relinquished by: _____ of: _____	Date _____ _____	Time _____ _____	Received by: _____ of: _____	Date _____ _____	Time _____ _____
Relinquished by: _____ of: _____	Date _____ _____	Time _____ _____	Received by: _____ of: _____	Date _____ _____	Time _____ _____
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: _____ of: _____	Date _____ _____	Time _____ _____	Courier Name: _____ _____ *Attach delivery/courier receipt to Chain of Custody	Date _____ _____	Time _____ _____
Relinquished by: _____ of: _____	Date _____ _____	Time _____ _____	Received by: _____ of: _____	Date _____ _____	Time _____ _____